Engineering Specification Report

Plant Design Document Analysis

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ENGINEERING SPECIFICATION ANALYSIS

Focus Area: Entire Document

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1. Purpose and Scope of Documents:

• Defines engineering requirements and recommended practices for design of piping systems and layout of process plant for INEOS Project One, Antwerp, Belgium; to be used in conjunction with referenced documents, the plant layout specification and piping material specification for process and utility piping systems (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 1. PURPOSE).

• Scope: defines basic design parameters and standards for design of piping systems and layout by FEED and EPC Contractor for onshore plants; explicitly excludes main pipelines, underground sewage/open drain systems, instrument piping, piping under national/local authority jurisdiction, and piping under ASME Boiler & Pressure Vessel Code (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 2. SCOPE).

• Piping Material Class index document governs pipe class definitions and general notes for piping material/component selection for Project One (From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 1. PURPOSE).

• Stress/specification scope: defines stress review requirements and pipe support criteria for Project One and shall be followed during all project stages (From "7650-8230-SP-100-0003_A3_Pipe Stress&Supt.pdf;", Section 1. PURPOSE).

• Insulation scope: covers hot, cold and dual-service thermal insulation for above-ground external piping and equipment for Project One; excludes underground lines and vendor-designed boiler/fired heater and refrigeration package insulation (From "7650-8440-SP-100-0001_A6_Insulation - Piping & Equip.pdf", Sections 1. PURPOSE and 2. SCOPE).

• Basic Engineering Design Data applies as base data for all disciplines for Project One (From "7650-8820-SP-100-0001_A11_Basic Engineering Design Data.pdf", Section 1. PURPOSE).

2. Applicable Codes, Standards, and References:

• ASME B31.3 (Process Piping) (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.2 Codes & Standards).

• ASME B31.1 (Power Piping) (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.2 Codes & Standards).

• ASME B16.5, B16.9, B16.10, B16.11, B16.20, B16.21, B16.25, B16.34, B16.36, B16.42, B16.47, B16.48, B36.10M, B36.19M (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.2 Codes & Standards).

• API standards cited: API STD 610, 617, 650, 661, API RP 686, API 5L, API 594, 598, 599, 600, 602, 608, 609, 623, 674, 675, 688 etc. (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.2 Codes & Standards; From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 4.2 Codes & Standards; From "7650-8230-SP-100-0003_A3_Pipe Stress&Supt.pdf;", Section 4.2 Codes & Standards).

• NFPA 30 and NFPA 58 (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.2 Codes & Standards).

• PED 2014/68/EU (Pressure Equipment Directive) (From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 5.1 PRESSURE EQUIPMENT DIRECTIVE; also listed in stress spec references "7650-8230-SP-100-0003_A3_Pipe Stress&Supt.pdf;", Section 4.2).

• NACE standards referenced (e.g., NACE MR0103, TM0177, TM0284, SP0472) (From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 4.2 Codes & Standards).

• ISO standards cited for welding NDT and insulation (multiple ISO entries, e.g., ISO 11971, ISO 14692, ISO 12241) (From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 4.2 Codes & Standards; From "7650-8440-SP-100-0001_A6_Insulation - Piping & Equip.pdf", Section 4. REFERENCE DOCUMENTS).

• Project standards list (7650-8230-SP-100-0001, -0002, -0003, -0006, -0016, -0018, 7650-8440-SP-100-0010/0011/0012 etc.) as explicitly listed (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 4.3 Project Standards; From "7650-8230-SP-100-0002_A14_Piping Matl Spec.pdf", Section 4.3 Project Standards; From "7650-8230-SP-100-0003_A3_Pipe Stress&Supt.pdf;", Section 4.3 Project Standards; From "7650-8440-SP-100-0001_A6_Insulation - Piping & Equip.pdf", Section 4. REFERENCE DOCUMENTS).

• Energy Institute guidelines and WRC reports for vibration and local nozzle stresses (WRC 107, 297, 449; Energy Institute vibration guidance) (From "7650-8230-SP-100-0003_A3_Pipe Stress&Supt.pdf;", Section 4.2 Codes & Standards).

3. Design and Performance Requirements:

• Pipe sizes: specified as Nominal Pipe Size; minimum NPS 1" except where specifically stated; disallowed non-standard sizes list; standardization rules for sizes >24" (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 5.1 Pipe Sizes).

• Flange usage: flange joints to be minimised; specific permitted uses listed; flat faced flanges to be used with flat faced equipment; bolt tensioning per piping class and 7650-8440-SP-100-0012 Controlled Bolt Tightening (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 5.2 Pipe Flanges).

• Smallbore piping: NPS 2" and below; smallbore connections defined by branch/main ratio <10% etc.; smallbore shall be butt welded; bracing and vibration assessment requirements per EI AVIFF and contractor submission (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Sections 5.3.1-5.3.3).

• Field welds: positioning to enable transport/erection; field fit weld allowance up to 100mm in up to three planes; trim rules for fittings and elbows; reference to weld proximity spec (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Sections 5.4.1-5.4.4).

• Pipe routing/elevations: minimum BOP elevations 500mm onsite, 600mm offsite; minimum clearances from items 50mm; spacing rules between parallel pipes (longitudinal flange stagger 150mm / 25mm bare pipe; increased to 75mm for NPS 30"+) (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Sections 5.5 and 5.6 Pipe Spacing).

- Access and ergonomics: Table 1 access requirements (minimum access methods per item/valve category) and valve ergonomics height/reach (Category 1: 500mm-1.5m height; reach max 300mm) (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Sections 5.7.1, 5.8.1 and Table 2).

- Line blinds/positive isolation: provision conditions and Table 3 specifying figure '8' vs spade/spacer sizes by flange class (From "7650-8230-SP-100-0001_A6_Piping Standard.pdf", Section 5.10 and Table 3

END OF ENGINEERING SPECIFICATION ANALYSIS